EXP.
As.6

The Mysore Agricultural Journal

(The Organ of the Mysore Agricultural and Experimental Union)

Vol. XX] 1941—42 [No. 3

IN THIS ISSUE

Suitable Procedures for Laying out Experiments in the Fields of Cultivators.

Liver Fluke Disease in the Irwin Canal Area.

1942

The

Mysore Chemicals and Fertilisers, Ltd.

(Manufacturing Operations were commenced in May 1940)

REGISTERED OFFICE:

1128, Vanivilas Road, MYSORE

Telegram : "CHEMI" Mysore

Telephone: 243

Works: BELAGULA

(Mysore State Railway)

on the way to Brindavan Gardens

(KRISHNARAJASAGAR)

Telephone: 435

Capital :

Authorised and Issued .. Rs. 25,00,000

(10% of the shares subscribed by Government of Mysore)

Manufacturers of

Sulphuric Acid, Ammonia, Ammonium Sulphate, Superphosphates

Fertiliser Mixtures and other Chemicals

CONTENTS

PAGE

Suitable Procedures for Laying out Experiments in the Fields of Cultivators—
By T. G. Rama Iyer, B.A., Director of Agriculture in Mysore 109

Statistics as applied to Agriculture—
By A. Anantha Padma Nabha Rao, B.A. 116

A Note on the Liver Fluke Disease in the Irwin Canal Area and the Control Measures adopted by the Special Scheme—
By N. S. Krishna Rao, L.V.P. 122

Bee Flora of a Coffee Estate—III—
By R. L. Narasimha Swamy, M.Sc. 125

The Amrit Mahal Cow as a Milk Animal—
By P. M. McIsaac, B.Sc. (Hons.), Ph.D. 128

SELECTIONS—

Peanut Meal in Livestock Production—How to Control Fleas—The Biology of the Tropical Cattle Tick and Other Species of Tick in Puerto Rico, with Notes on the Effects on Ticks of Arsenical Dips 130

List of Publications with Important Contents received at the Mysore Agricultural and Experimental Union 137

THE MYSORE AGRICULTURAL JOURNAL

A Quarterly Magazine Published by
The Mysore Agricultural and Experimental Union (Regd.)

BANGALORE

Chief Editor :

M. J. NARASIMHAN, B.A.,
Deputy Director of Agriculture.

Subscription Rates :

FREE TO MEMBERS OF THE UNION

Rupees 3-5-0 per Volume to Non-Members

ADVERTISEMENT RATES ON APPLICATION

For particulars apply to :

SECRETARY

The Mysore Agricultural & Experimental Union

Seshadri Road, BANGALORE

SAFETY

From all those plant-destroying insects. For real proof that the efficacy of Mysore Insecticidal Soap is thorough and lasting, you have only to use it for a few days and note results.

Mysore **INSECTICIDAL** *Soap*

Government Soap Factory, Bangalore.

The Mysore Agricultural Journal

(The Organ of the Mysore Agricultural and Experimental Union)

Vol. XX] 1941—42 [No. 3

Suitable Procedures for Laying out Experiments in the Fields of Cultivators*

By

T. G. Rama Iyer, B.A.

(*Director of Agriculture in Mysore*)

The transmission of the benefits of agricultural research to the raiyat's field is one of the most important practical problems in improving the lot of the agriculturist. For want of satisfactory arrangements to furnish this connecting link, Agricultural Departments often come in for unmerited blame that they are not of any practical benefit to the raiyats. Any satisfactory method to be devised for the purpose has to take into account the nature of the raiyat, a very conservative and often illiterate person, sceptical about any improvements. Safety first in the beaten track is his motto in life. Advice, oral or written, makes little impression on him.

During the last five years I had a good opportunity to carry on certain methods of work for transmission of the benefits of research to the raiyat's practice. The easiest method of approach is obviously the introduction of improved variety of crops. Manurial and cultural improvements take a very long time to appeal to him. They also exact more money and labour than many poor raiyats can command. But a call to him to simply change the seed meets with an easy response as no other factor in his cultivation is disturbed by this. The line of work adopted by my Department is the formation of subvention farms, followed by demonstration plots which in its turn is followed by seed farms.

The Subvention Farm is a small experimental farm of an acre or two in the holding of a leading and progressive raiyat. The several improved

* Paper contributed to lead discussions at the fourth meeting of the crops and soils wing of the Board of Agriculture, Imperial Council of Agricultural Research, New Delhi.

varieties of cane or paddy or cotton or groundnut of this State as well as from the adjoining Provinces are sown or planted along with the local in equal plots in a more or less uniform field selected for the purpose. The Departmental Fieldman supervises sowing or planting. The raiyat carries on cultivation according to his usual method. At the time of harvest the fieldman again watches the operation and all inquisitive raiyats also watch the separate heaps harvested from the separate plots of the several varieties. The owner of the Subvention Farm naturally discusses the merits of individual varieties for earliness, yield, water requirements and the trouble and labour involved. He and his neighbours are then asked to select the best variety that suits their tract of country. They do so and there has been no occasion for any differences with the Department as the pros and cons of each variety are discussed with us also. The owner of the Subvention Farm is then paid a subvention of Rs. 100 per acre for sugarcane, Rs. 50 per acre for paddy, Rs. 25 per acre for a dry crop for his trouble and attention. The seed is given free and the raiyat takes the whole crop. It has been found that the Subvention Farm has a high educative value. The raiyat is trained to compare the merits of different improved strains from all points of view. The working of the Subvention Farms is under the control of the Botanical (plant-breeding) Section.

Once the local raiyats are convinced of the merits of a particular improved strain in the Subvention Farm, then a large number of demonstration plots are laid in the holdings of different raiyats in the locality, the improved seed being supplied free for about one-quarter to half an acre. Smaller demonstration plots make it easier for a raiyat to see side by side at a glance the difference between the improved and local strains than demonstration plots of bigger size. It also enables the Department to lay out a large number of demonstration plots at a very low cost, the only expenditure to the Department being free seed. The raiyats watch the several demonstration plots.

Thereafter the demand for improved seed grows enormously. One of the best raiyats in the area is selected and he is asked to grow a seed farm of 10 to 20 acres to serve the needs of that zone. He is given good seed as an advance which he returns with 10 per cent. addition at the time of harvest. The rest of his crop is purchased for seed according to agreement at 10 per cent. above the market value for seed.

It has been found that by this method my Department has been able in our own humble way to proceed from research and propaganda to schemes for increase of production. The intensive work carried on in extending improved varieties of paddy has culminated in a five-year scheme with twenty Paddy Inspectors for intensive work of subvention farms, demonstration plots in raiyats' fields and for collection and distribution of seed to cover an area progressive from year to year. In the case of com-

mercial crops work done on similar lines will not give proportionate benefit to the raiyat unless the work of the Agricultural Department ends in a large-scale State controlled scheme for processing and marketing like sugar factory, ginning and pressing factory for cotton, curing and grading stations for tobacco, sheep breeders' associations, poultry associations, bee-keepers' co-operative societies and the like. If similar arrangements are not provided, there is danger of the work sliding backwards and of the raiyats not getting the economic benefits of agricultural research.

I may state here to avoid misapprehension that the methods I have recommended are necessary only in the case of raiyats who are backward and not progressive. They are not necessary in the case of the very progressive raiyats or in the cases where large-scale agriculture on estate scale is carried on by intelligent farmers who know the value of research to them.

As a result of the methods adopted by my Department, the value of improved seed sold in the Departmental Depots has increased over tenfold in five years, which is a tangible measure of the transmission of the benefits of plant-breeding work to the raiyat's pocket. The number of subvention farms, demonstration plots and seed farms in 1941–42 is given hereunder:—

	Subvention farms		Demonstration plots	Seed farms
Paddy	140	Varietal ..	1,655	442
		Manurial ..	55	
Sugarcane	29	Varietal ..	187	9
		Manurial ..	53	
Ragi	1		1,807	116
Groundnut	..		203	27
Cotton	13		465	5
Jola	5		98	..
Poovan plantain	..		51	..
White til	..		137	..
Fodder	..		11	..
Inter-cropping	..		73	..
Others	1		136	..
TOTAL ..	189		4,931	599

A statement is also appended to this note (*Vide* Appendices I and II) to show the different varieties of crops issued usually to the several subvention farms for different crops. Another statement is appended to show the result in a few demonstration plots (*vide* Appendix III).

APPENDIX I. *Yields of different strains of paddy in Subvention Farms laid during* 1940–41

Circle	Range	Place	Acre yields												
			S. 199	S. 246	S. 661	S. 699	S. 624	S. 476	S. 67	S. 139	S. 831	S. 799	S. 269	G.B. 24	Local
1. Bangalore	Channapatna	Doddamalur	959	1,580	1,106	1,380	1,260	1,050	1,459	1,234	..	..	..	..	
Do.	Bangalore	Rupenagrahar	1,920	2,400	2,560	2,385	1,520	2,066	2,464	2,400	..	..	..	..	1,714 Halubbalu
Do.	Doddaballapur	Shivapura	512	480	541	533	80	480	533	747	..	..	..	..	400 Doddabyra
2. Chitaldrug	Hosdurga	Ballalasamudra	1,270 (S. 197)	1,490 (S. 236)	1,460	1,285	1,250	1,125	..	..	390	1,175	..	..	1,145
3. Hassan ..	Hole-Narsipur	Hole-Narsipur	1,407	1,446	2,227	2,090	1,894	1,192	1,078	1,008	..	..	..	..	
Do. ..	Hassan	Sakleshpur	1,373	1,000	1,320	1,460	1,180	1,320	1,300	1,453	..	..	..	..	1,420
4. Kolar ..	Bowringpet	Madampalli	626	517	880	373	573	680	933	853	..	..	..	..	1,020 Basumathi
Do. ..	Chintamani	Laxmipur	1,115	1,051	970	897	691	565	874	1,739	..	..	..	..	
5. Mandya ..	Krishnarajpet	Krishnarajpet	2,100	2,040	2,562	1,600	1,570	1,492	1,600	2,000	..	..	..	..	1,920 S. 684
Do. ..	Maddur	Maddur	960	1,320	1,120	960	1,320	1,520	1,720	1,320	..	..	..	..	1,200
Do. ..	French-Rocks	Hadisettihalli	1,600	2,016	1,664	1,664	1,744	1,408	1,387	1,472	..	..	..	..	
6. Mysore ..	Nanjangud	Horalwadi	1,740	1,818	1,558	1,736	1,658	1,400	1,727	1,472	..	..	..	..	1,428 Local kaddi
Do. ..	Krishnarajnagar	Hampapur	1,272	1,344	1,105	1,104	2,216	1,092	1,628	1,582	..	..	..	..	1,800 S. 661 Check
Do. ..	T.-Narasipur	Kodagalli	1,600	1,933	2,500	2,033	2,613	2,946	2,170	1,966	..	..	..	..	1,986 Local G.E.B. 24
7. Shimoga ..	Thirthahalli	Tudki	1,124	1,071	1,377	1,222	1,222	1,160	1,516	1,529	..	..	1,178	1,546	1,513 Musalli
Do. ..	Shimoga	Ayyanur	1,816	1,984	1,160	1,600	2,016	1,329	1,024	1,744	..	..	2,072	..	
Do. ..	Shimoga	Bhadravati	1,320	1,760	1,160	2,620	1,688	880	940	1,048	..	..	..	..	2,000
8. Tumkur ..	Kunigal	Shanbhoganahalli	680	1,128	960	1,152	1,064	828	732	776	..	..	..	..	1,092 Pattasamanahalli sanna
Do. ..	do.	Kantanahalli	480	680	680	840	672	528	528	1,180	..	..	..	..	840 Bile sanna
Do. ..	do.	Kadaba	54	69	125	313	24	157	330	312	..	..	..	..	240 Devamallige

Summer Paddy Subvention Farms

Circle	Range	Place	Acre yields				
			S. 705	S. 396	S. 317	S. 547	Local
1. Bangalore	Dodballapur	Aralumallige	1,466	1,200	1,786	1,632	1,114 Doddakesari Check
2. Do.	Bangalore	Rupenagrahar	2,040	941	2,240	2,087	2,080 Local Halubbalu
							2,045 Local Halubbalu Bulk Paddy
3. Chitaldrug	Challakere	Nayakanhatti	2,000	714	1,579	1,143	1,477 Local Halubbalu
							1,103 Local Kembuthi
							1,000 Local Kemkadale

Appendix II

Sugarcane Subvention Farms in the State during 1941

District and Taluk	Village	Varieties of cane
Bangalore District—		
1. Bangalore Taluk ..	Rupenagrahar	Local, H.M. 320, H.M. 544, H.M. 544 Str., H.M. 608, H.M. 607, Co. 360, Co. 419, H.M. 647, H.M. 661, H.M. 653, H.M. 645.
2. Devanhalli „ ..	Kodi Manchenhalli	Local, H.M. 320, H.M. 544, H.M. 608, Co. 419, H.M. 661, H.M. 647, H.M. 657, H.M. 656, H.M. 645.
3. Dodballapur „ ..	Kodihalli	
4. Channapatna „ ..	Doddamalur	
Kolar District—		
5. Malur Taluk ..	Santhehalli	Local, H.M. 320, H.M. 544, H.M. 607, Co. 419, H.M. 647, H.M. 661, H.M. 659, H.M. 656, H.M. 657, H.M. 651, H.M. 645.
6. Chikballapur Taluk ..	Ganganamidde	Local, H.M. 320, H.M. 544, H.M. 607, H.M. 647, H.M. 661, H.M. 659, H.M. 657, H.M. 656, H.M. 645.
7. Sidlaghatta „ ..	Anur	Local, H.M. 320, H.M. 544, H.M. 607, Co. 419, H.M. 647, H.M. 661, H.M. 657, H.M. 656, H.M. 645.
8. Bagepalli „ ..	Gulur	Local, H.M. 320, H.M. 544, Co. 419, H.M. 647, H.M. 661, H.M. 657, H.M. 656, H.M. 654, H.M. 645.
9. Do. „ ..	Nallappareddipalli	Local, H.M. 320, H.M. 544, H.M. 607, H.M. 657, H.M. 656, H.M. 645, H.M. 661, H.M. 647, Co. 290.
10. Goribidnur „ ..	Sabbanahalli	Local, H.M. 320, H.M. 544, H.M. 544 Str., Co. 419, H.M. 607, H.M. 608, H.M. 647, H.M. 661, H.M. 657, H.M. 656, H.M. 645.
11. Srinivaspur „ ..	Kolathur	Local, H.M. 320, H.M. 544, H.M. 607, Co. 419, H.M. 647, H.M. 661, H.M. 656, H.M. 657, H.M. 645.
12. Chintamani „ ..	Somayajalapalli	Local, H.M. 607, H.M. 647, H.M. 320, H.M. 544.
Tumkur District—		
13. Tiptur Taluk ..	Nonavinakere	Local, H.M. 320, H.M. 544, H.M. 607, H.M. 608, H.M. 645, H.M. 661, H.M. 647, Co. 290, Co. 419.
14. Kunigal „ ..	Kunigal	Local, H.M. 320, H.M. 544, H.M. 608, H.M. 607, Co. 419, H.M. 647, H.M. 661, H.M. 657, H.M. 645.
Chitaldrug District—		
15. Davangere Taluk ..	Kalapanahally	Local, H.M. 320, H.M. 544, H.M. 553, H.M. 608, H.M. 607, H.M. 647, H.M. 661, H.M. 645, H.M. 657.
16. Holalkere „ ..	Chitrahalli	Local, H.M. 553, H.M. 320, H.M. 544, H.M. 607, Co. 290, H.M. 647, H.M. 661, H.M. 657, H.M. 645.

there has come into being the possibility of controlling them by other and simpler means. The syringe is replacing the seasons, for it is becoming possible by administering the appropriate hormones or their synthetic equivalents to exert a very complete control over the sexual and reproductive activities of our animals.

To me it seems that the time has now come when the live-stock industry must gain the power of controlling the secondary sex-ratio. It cannot much longer remain content to allow the numerical proportions of males and females among the newly-born in dairy herds of cattle and goats and in flocks of poultry to be decided by the operations of blind chance. Such power can be secured and, I think, should be secured. In the domesticated mammals this control if Walton's work at Cambridge is adequately encouraged, will emerge from researches relating to the separation of the two kinds of spermatozoa. If I may be permitted to be prophetic, and at the same time assume that the policies and programmes of live-stock improvement in the immediate future will be born of a lively intelligence, I predict that the time will come when all the sires that will be used will be congregated in a few centres, and that the beribbened swaggering stallion will be seen no more upon our roads. He will give place to a small glass phial enclosed within a registered letter. Then the progeny test will claim a reliability that at present it cannot hope to possess. In the case of poultry the problem of the control of the secondary sex-ratio will not so easily be solved, for here it is the female that elaborates the two kinds of gametes. In a poultry population, generally, it seems that there are two kinds of eggs: those being fertilized, destined to yield males, and those which inevitably will develop into females, are elaborated in equal numbers. But careful search may be expected to disclose individuals which habitually yield a preponderance of females. In other forms 'sex-ratio' genes have been identified and are known to disturb the mechanism responsible for the production of the two kinds of eggs. These genes can be incorporated into stocks by appropriate genetic procedures and by their aid a secondary sex-ratio of any desired dimension can be obtained. On the other hand, it may prove to be more desirable to transform the majority of male embryos into females during the earlier stages of incubation by means of injection of 'feminizing' hormones into the egg. Undoubtedly this can be done, but it remains to be shown that such a procedure can with advantage be transferred from the laboratory to the farm.

The Breeder.—I will end as I began, by reminding myself and you that the geneticist knows that inborn qualities find full expression only in an optimum environment. The most important feature in the environment of our live-stock is the breeder himself. The chief

prerequisite in all live-stock improvement is improvement of the men in charge, the practitioners of agriculture, the veterinarians, and especially the improvement of privileged people like myself who are given such plentiful opportunities for self-expression and for public service. The need for new knowledge is urgent, but knowledge remains sterile and wasted until it can be exploited in the true service of mankind. No research is of any considerable value until its benefits can be appreciated by the actual practitioners. Science has contributions to offer, but only to the educated and intelligent. The chief obstacle to the application of genetic principles in live-stock breeding commonly seems to be the inability on the part of the breeder to understand the jargon of the geneticist. Yet the man to whom heterozygosity is a mystery and linkage a myth speaks familiarly of the most intricate details of a tractor.

—*The Empire Journal of Experimental Agriculture,* Vol. 7, No. 25.

1794-40—Printed at The Bangalore Press, Mysore Road, Bangalore City, by G. Srinivasa Rao, Superintendent

Statistics as applied to Agriculture

By

A. Anantha Padma Nabha Rao, B.A.

Statistics, as commonly understood, is a collection of a huge mass of figures. Such figures are published every year by almost all organisations. Once figures are collected, the more important and difficult task lies in their correct interpretation for a clear understanding of the problem. As a result of intensive research by mathematicians, statistical methods have been evolved to study thoroughly and accurately all problems including forecasting of weather and yield and diseases of crops.

In Mysore, statistics on area and yield of crops, livestock and exports and imports of most commodities are being published every year by the concerned Departments. Various attempts have been made from time to time to study these figures. It is of interest to recall here, the illuminating address of the Director of Agriculture to the Mysore Civil Services Association in 1940. He has revealed the pathetic situation of the agricultural position in our State. He has shown how much we depend for our food and clothes on imports, the extent to which our money goes out of Mysore and the degree to which the agricultural production of the State should be increased. This problem becomes naturally more serious with the steadily increasing population.

The Agricultural Department has been solving this problem by evolving superior varieties in crops, better methods of manuring and more efficient cultural practices. But the more difficult problem was in comparing the new varieties, manurial and cultural practices with the local ones on the field and to transfer the results of such comparisons to the raiyat's field. The credit of solving these problems and thus doing greatest service to agriculture goes mainly to two mathematicians, Prof. Fisher and Prof. Yates, who evolved suitable statistical methods to collect the necessary figures economically and accurately, to interpret them in order to obtain reliable results and finally to test the applicability of these results to different soils and climatic conditions.

An attempt will be made to explain briefly the necessity for statistical methods in agricultural research, the methods that are now being adopted by the Mysore Agricultural Department to solve the raiyat's problems and thus increase the agricultural production of the State. Experiments on field are essential in agricultural research to test the different varieties of a crop, different manurial and cultural practices newly evolved. Field experiments are more complicated than what they appear to be, requiring the services of a specialist.

Take the simplest case of comparing a new variety (A) of paddy with the local variety (B). The method that suggests itself is to grow them on two plots, variety (A) in the first and variety (B) in the next plot (Fig. 1).

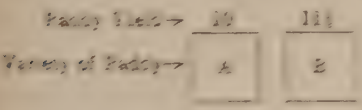

Fig. 1

Commonsense tells us that the two plots must be of the same size and shape and must be manured to the same extent. If the yields obtained are 10 pallas for A and 11½ pallas for B, the area of each plot being ½ acre, the obvious conclusion is that local variety (B) gives 3 pallas more per acre than the new variety (A).

Take another simple example of testing the effect of four doses, 0, 10, 20, 30 cwts. per acre, of a new manure mixture on sugarcane. As before four plots, all of same size and shape with one variety of sugarcane would be selected and the four doses of the manure applied (Fig. 2). If the yields obtained are 16, 17, 20 and 22 tons, the obvious conclusion is that increasing doses of the new manure give higher yields. But both these conclusions are unreliable and cannot be advocated to the raiyats without testing by modern statistical methods. Because, fortunately or unfortunately, in the first trial (where the two varieties A and B were tested) there was a third plot with the new variety (A) in it, which gave an yield of 14 pallas (Fig. 3). The result is now confusing. Local variety (B) cannot be said to yield more than the new variety (A) or *vice versa*.

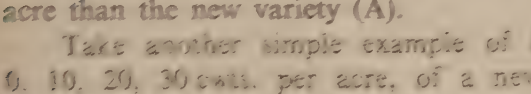

Fig. 2

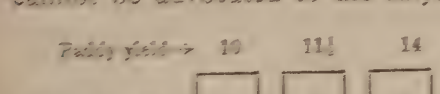

Fig. 3

Similarly, in the second trial where the four doses of the manure were tried, there was a fifth plot unmanured, similar to the first plot which gave an yield of 23 tons of cane (Fig. 4). Here again, the

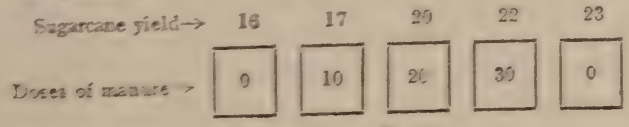

Fig. 4

previous conclusion is upset; for even without any manure the fifth plot has given a high yield. Thus the yield figures are confusing. The differences in yield observed in the two cases are highly influenced by differences in soil fertility and environment. And it is due to this fact, to quote Sir John Russel, " Field Experiments, simple as they appear to non-experts, rarely give clear-cut results. With only single plots a result may seem to emerge but the results are confusing if plots are replicated." The

truth of this statement can further be seen in the following yield figures (Fig. 5) from a bulk crop of one variety of groundnut taken from an apparently uniform block of land divided into 36 plots, all of equal size (13 × 13 sq. yards) and shape. Large variations are present in the yield (given in lbs.) figures even though they are from plots of same size and shape. Evidently much more varying and confusing will the yield figures be, if different varieties are grown to test them. It is now clear that yield figures are influenced by many factors, known and unknown, controllable and uncontrollable, imposed by nature on the experiments, in addition to the factors imposed by the experimenter for purposes of comparing. Mathematical methods have been found necessary to overcome the difficulties mentioned above and to obtain reliable results.

Yield of HG1 groundnut from 36 plots in lbs.

88	84	69	75	63	70
69	90	87	88	86	92
102	92	99	77	79	81
98	89	75	76	68	72
82	83	69	71	63	62
68	72	59	70	67	61

Fig. 5

Take the simple case of fixing the average yield of a crop, say sugarcane, for a certain village. If a one-acre plot of sugarcane is selected and if the yield is 40 tons, this single result will not be reliable as will be seen if some more, say five one-acre plots are selected at random and harvested under the same conditions. If the yields are 25·0, 33·7, 36·2, 37·5 and 38·7 tons, the average (35·2 tons) of the six yield figures will represent to a greater extent the true yield of cane for that locality. This is nearer the truth than the single figure of 40·0 tons obtained from one plot. It is usual to argue from particulars to the general or as the statistician puts it, from the sample to the population from which the sample is drawn. Valid inferences are drawn from experimental results. But any inference from the sample to the population is always attended with some degree of uncertainty or improbability. Thus a dogmatic statement that the yield of sugarcane in that village is 35·2 tons per acre cannot be made. The statistician does not rely on the average yield without examining the individual yield figures, for the variation. Here, the average yield is 35·2 tons with a range of variation of 15 tons (varying from 25 to 40 tons). From the individual deviations a statistical constant called the Standard Deviation or the Error of the yield figures is calculated which gives to the statistician the only reliable and satisfactory measure of the intensity of variation present in the population from which the sample of six was obtained. This statistical constant is such that about 95 per cent. of the yield figures which constitute the population will be within the limits of the mean ± twice the Standard Deviation, *i.e.*, between 35·2 ± 10·8 tons. In a similar way, (2·2 tons) the Standard Deviation or the Error of the mean yield, will give the range within which about 95 per cent. of the means

of groups of six yield figures vary, *i.e.*, between 30·8 and 39·6 tons. These considerations apply for yield figures distributed normally and whose exact values are known. In practice, only a few values of the population are available from experiments either in the laboratory or on the field. Researches of a famous statistician, 'Student' who has preferred to be anonymous, and Fisher's development on them have made it possible to apply the ideas mentioned earlier to the few figures usually available from experiments. These considerations roughly solve the problem of comparing the yields of any two varieties or the effect of any manure and it is mainly on these principles that modern experimental technique has been developed.

Take the problem of testing five varieties of paddy, A, B, C, D and E. The idea of growing them on five plots varying in size (say 2, 2½, 1, 3 and 4 guntas) and shape (Fig. 6) and comparing the calculated yields per

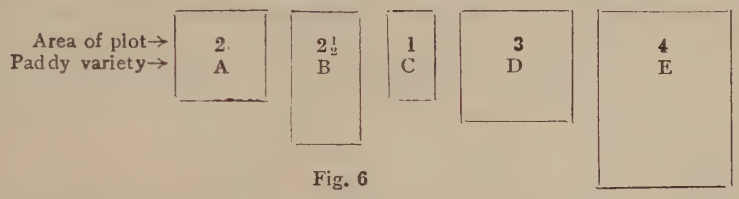

Fig. 6

acre, has to be given up if reliable results are required. It was also seen that unreliable results are obtained even when the plots are of the same size (say 2 guntas) and shape (Fig. 7) and the yields are compared. The

Fig. 7

method that suggests itself is to grow each variety in a number of plots (Fig. 8) and compare the mean yields with respect to their Errors.

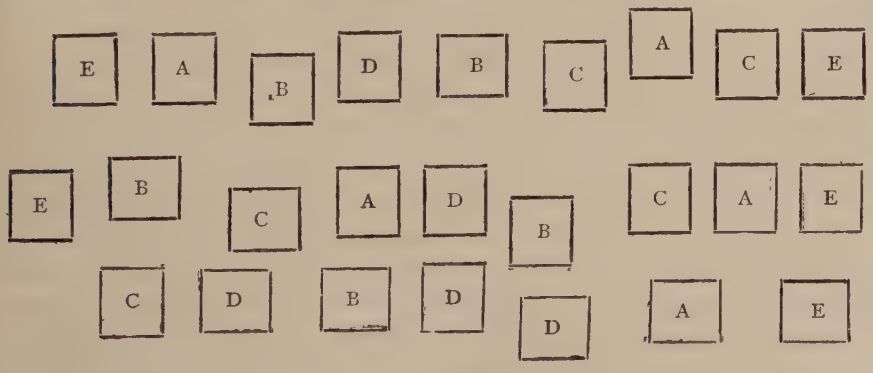

Fig. 8

The varieties could be easily judged regarding their performances knowing the range within which the mean yields vary by chance. Thus replication of plots is the first principle in modern experimental technique which gives

some precision to the experiment. The defect in this arrangement is that only large differences in the mean yields can be detected due to the large Errors usually present. A successful experimenter must try to reduce the Error to the minimum and increase the precision of the experiment. This is achieved by a proper field arrangement of the plots, *i.e.*, by demarcating the experimental area into blocks. For the five varieties, there would be five plots in each block and there would be a number of such blocks (Fig. 9). It is also necessary to distribute the varieties in each block at random (Fig. 10) instead of in the regular order so as to obtain a valid estimate of the Error. This system of replication is what is commonly called the method of Randomised Blocks. Here the Error is reduced by the removal of the effect of soil variation in one direction and the precision of the experiment is increased. Further precision is achieved by the use of another method known as Latin Square wherein the effect of soil variation in two directions is removed. Here, five blocks each with five plots would be selected and the five varieties so distributed that all the varieties appear in each row and in each column (Fig. 11).

A	B	C	D	E
A	B	C	D	E
A	B	C	D	E
A	B	C	D	E

Fig. 9

B	D	A	E	C
D	A	E	C	B
A	E	C	B	D
C	B	D	A	E

Fig. 10

B	C	D	A	E
E	D	B	C	A
D	B	A	E	C
C	A	E	B	D
A	E	C	D	B

Fig. 11

These two systems of replications—Randomised Blocks and Latin Squares—are very simple, accurate and reliable methods to solve simple problems, problems such as were existing in olden days. But the present-day agricultural problems that have to be solved are not simple. The plant-breeder evolves a large number of varieties running up to hundreds and the chemist has a number of manurial mixtures to be tried at various levels under different methods of cultivation on a number of varieties. In addition, experiments on duty of water, rotation of crops, perennial crops, diseases and pests of crops are more complicated than what they appear to be. Suitable sampling methods are necessary for the study of quality of crops. For an accurate study of such problems, the two methods of Randomised Blocks and Latin Squares are inefficient. Recently methods or designs such as split-plot designs, factorial and quasi-factorial designs, incomplete Randomised Blocks, etc., have been evolved by statisticians to solve the present-day complicated agricultural problems efficiently and economically. They are extremely complicated both in design and in interpretation, requiring the services of specialists. As such, they are possible only on the experimental farms of the Department where the necessary care, supervision,

direction and expenditure are easily available. These methods have been in use since 1939, on the experimental farms of the Mysore Agricultural Department and it is from these that very valuable and promising results have been obtained with regard to varieties, manurial and cultural aspects on all important crops. Subvention farms on the raiyats' fields serve the purpose of testing these results in representative localities. In order to obtain reliable results regarding superior varieties in crops, economically remunerative methods of manuring and efficient cultural practices and to thus really increase the agricultural production of the State, very simple statistical methods are available.

A Note on the Liver Fluke Disease in the Irwin Canal Area and the Control Measures adopted by the Special Scheme

By

N. S. Krishna Rao, L.V.P.

The heavy irrigation and the abundant supply of water in the Irwin Canal area, which has incidentally given rise to a severe type of malaria among human beings, has also for similar reasons given rise to the Liver fluke disease among cattle. The harm caused by this is realised on the comparison of the present cattle census with that existing before the advent of the channel. Information collected directly in the villages in the area go to show that 10 per cent. of the cattle, 50 per cent. of the buffaloes and 75 per cent. of the sheep and goats have already been destroyed. But, what is more serious is that many professional people have given up rearing these animals as 'hopeless'. Mandya, famous for the production of butter and a mutton type breed of sheep is so deteriorating in this respect that it may lose its unique place, unless proper measures are adopted. The condition of the draught and plough bullocks, too, excepting those purely stall-fed is miserable.

The reason for the high incidence of the disease in these parts is that the increase in the level of the sub-soil water on account of the heavy irrigation and in the incessant flood of seepage water in all directions has converted vast areas into marshy lands, especially round about the tanks. These marshy lands form a very fertile ground for the growth of snails through which this parasite, the "Liver fluke", passes a part of its life-cycle and spreads itself. The snail plays a similar part in the spread of this disease as the mosquito in the spread of malaria. A knowledge of the life-history of the parasite will enable us to appreciate this. Briefly it is as follows:—

The mature flukes harbour in the liver of the infected animals. The eggs are passed out in the fæces of the host which mature under the necessary conditions of warmth and moisture and a free swimming *miracidium* escapes out (refer diagram). If this should find a suitable snail, it penetrates its body tissues and undergoes further development, or else it dies. In the snail it transforms itself into a *sporocyst* which in the following 2 to 4 weeks divides itself into 5 to 8 *rediæ* and from these daughter *rediæ* may form. From 4 to 6 weeks more, in each *rediæ* are formed 15 to 20 oral tadpole like *cercaria*. These *cercaria* after casting off their tails attach themselves to blades of grasses secreting a sticky substance which dries up immediately. These look like grains of

sand of size 2 to 3 mm. Some *cercaria* float on water and some may remain in the deeper levels. In animals consuming such grass or the contaminated water, infection is almost certain. In this way under favourable conditions 150 to 300 or more *cercaria* may develop from one egg, and about 10 millions from each fluke. A buffalo may harbour more than 1,000 flukes and a sheep more than 400 and from this it is obvious that a wet pasture may become heavily contaminated even with a few carriers to begin with.

The *cercaria* accidentally taken in by a susceptible animal through water or grazing, enter the intestines where the *cyst* is dissolved and the fluke liberated. These finally enter the liver, chiefly by way of boring through the wall of the intestines and then the capsule of the liver. Some may go up the bile ducts and a few are carried through the portal vein.

The pathogenic effects of the parasites are produced chiefly by:

1. The destruction of the liver tissues and blood on which the parasites live.

2. The absorption of the metabolic products of the flukes or the hæmolytic toxin which the parasite is credited to produce.

3. The cuticular spines of the flukes causing inflammation of the bile ducts and liver.

4. The blocking of the bile ducts by the worms causing stasis of the bile and jaundice. This stasis with the help of the desquamated epithelium may predispose the animal, for the formation of gall stones, the former acting as the nucleus round which the stones are formed; and

5. Massive infection may cause rupture of the liver.

The chief symptoms of the disease are, briefly, gradual emaciation, irregular bowels and in the final stages continuous diarrhœa. Some breeds of sheep develop a prominent œdamatous swelling in the jowl but this is not seen in the Mandya breed.

A special scheme has been in force for the control of this disease, since July 1941, and the following, enumerated briefly, are the preventive and curative measures that are being adopted at present:—

I. *Destruction of the intermediate host, the 'snail'*, is an important item of prevention and this is done (1) by adopting a biological control; (2) by destroying the snails by chemicals; and (3) by collecting and destroying the snails mechanically.

1. There are two means of biological control: (*a*) Certain fishes are known to prey upon the snails and the *miracidia*. As advised by the Fisheries Officer of the Department of Agriculture, experimental ponds are under construction to rear these and further results are awaited; (*b*) Ducks eat away the snails while grazing. A small duck farm has been started at Kothathi, a village, 5 miles distant from Mandya. There are 74 birds at present, out of which 5 are males. During January 1942, 1,189 eggs were laid and Rs. 21 was realised by their sale. There is a ready local market

for the eggs. The expenditure incurred during the month including the pay of the care-taker is Rs. 17. Apart from other considerations, the Irwin Canal area has some special advantages for rearing ducks on account of (i) a number of tanks made perennial by the inflow of seepage water; and (ii) its being a paddy growing area. The birds thrive very well on the grains of paddy left after harvest. As a matter of fact, some of the dealers who maintain huge flocks of these birds round about Bangalore, send them all the way to this area during the harvest season. Even with the few birds that are here at present, it has been possible not only to make it self-supporting but also leave a small margin of profit. It is under consideration to start several centres, each having at least 400 birds in villages notorious for the disease and having tanks near by. This will minimise the snail population and also give an impetus to a profitable industry in this area.

2. *Destruction of snails by chemicals.*—A solution of copper sulphate of dilution of 1 in 5 to 6 million parts of water destroys the snails, *miracidia* and *cercaria*. A stronger solution to accommodate for the dilution it undergoes, is sprayed by a double hand pump with long hose pipes. A great difficulty that is being met with is that the free flow of seepage water dilutes the solution so much that it becomes too weak to be effective. Hence, at present, a few selected areas are being taken up. As an anti-malarial measure, a programme of constructing deep channels for directing the flow of seepage water will be taken up by the Department of Public Works shortly. When this is done, spraying work will be pushed through vigorously to make it effective and useful.

3. The direct method of collecting snails and destroying them is also being encouraged. As an inducement, payment is being made to the villagers at the rate of a couple of annas per basket of snails collected. The collected snails also serve as raw product for preparing shell grit which is being tried by the special poultry officer to find out its suitability for inclusion in the poultry feeds.

II. *Curative measures.*—All susceptible animals are dosed systematically with carbon tetrachloride, a durg that has become very prominent as an effective and cheap wormicide against the blood sucking parasites.

A convenient method of administering carbon tetrachloride to suit local conditions has been evolved after some preliminary trials during August, 1941. The drug is mixed with groundnut oil, 1 in 4. Four c.c. of the mixture (contains 1 c.c. of drug) is given to sheep and 16 c.c. to cattle (4 c.c. of the drug).

Bee Flora of a Coffee Estate—III

By

R. L. Narasimha Swamy, M.Sc.

Nature has bestowed Mysore Malnad with a vast flora which the bees make use of to produce honey. A study of the flora particularly with reference to the utilisation of the same by the bees illustrates how easily bee-culture can be practised even as a hobby. The two brief lists of plants published in this *Journal** along with the present one is the result of such a study pursued during leisure hours. In the nature of it the scope of the study is limited; the lists are brief; but, they illustrate the rich and varied nature of the flora which the bees can use. Evidently there are more plants which the bees may use. It is left for a concentrated study to bring them to light. But, that does not prevent the writer's slow progress in view of the aim to point out to coffee planters that bee culture could be easily taken up by them to be practised during their leisure hours as a hobby surrounded as they are by large numbers of varied plants which provide the necessary raw materials for the bees to produce honey.

Crop Plants

Areca catechu.—Beetle-nut palms are visited by bees in large numbers for pollen throughout the day. The fine fragrance of the flowers coupled with the humming noise of the bees will make a pleasant visit of an areca garden.

Cocos nucifera.—Cocoanut palm, though not very common, occurs occasionally in and round about coffee estates. The flowers of the palm are visited by bees in numbers for pollen throughout the day.

Vitis vinifera.—Flowers of the grape-vine are visited by bees for honey throughout the day.

Shade Trees and Other Useful Plants

Ficus glomerata and F. mysorensis.—*Atthi* and *goni* of which the former particularly are used as shade for coffee. I have seen bees hovering about the receptacles in large numbers till a late hour in the morning. But the reason has not been ascertained.

Mangifera indica.—The mango trees common in the Malnad are visited by bees throughout the day to collect pollen. The trees flower during January–March.

---

* "Bee Flora of a Coffee Estate—I and II," *The Journal of the Mysore Agricultural and Experimental Union*, Vol. XVIII, No. 1, pp. 11–15 and No. 4, pp. 170–72.

Emblica officinalis.—*Nelli* trees common in and round about coffee estates are visited by bees in large numbers both during morning and till a late hour in the evening for pollen. The trees flower from March till May.

Lagerstræmia lanceolata.—*Nandi* trees flower from March–June. The flowers are visited by bees in large numbers for pollen during morning and evening hours.

Plumbago capensis.—A species of *chitramula*; it is used as a hedge in gardens. Flowering begins from April and continues till December except during the south-west monsoon months of July, August and September. The bees visit the flowers for pollen during the morning hours.

Poinsettia pulcherrima.—An ornamental shrub; it is frequently grown in gardens and it flowers during the cold season, November–January. The bees visit the flowers for pollen and, also, for honey stored in the cup-like nectary.

Cucumis sativus, Cucurbita pepo and Cucurbita maxima.—Cucumber, pumpkin and squash gourd are all cultivated as vegetables in the estates. The flowers of these are visited by bees for pollen, but, more for the honey secreted by the hairs at the base of the stamens on the corolla.

Jungle Trees

Flacourtia ramontchi var. *latifolia.*—The species is a small tree, the flowers of which are visited by bees during morning times for honey secreted by the disc and also for some pollen. The trees flower during March–May.

Clausena heptaphylla.—A small tree, it flowers from March–May. The flowers are visited by bees throughout the day for honey.

Heynia trijuga.—The trees flower from February–April. Bees visit the flowers for honey during morning and evening hours.

Acacia torta.—This climbing shrub quite common round about coffee estates begins to flower by about May and continues till as late as October or November. Bees visit the flowers for pollen throughout the day. They gather honey from the glands on the leaf petiole.

Schefflera venulosa and *S. Wallichiana.*—These small trees blossom during March–June. Bees visit the flowers throughout the day in large numbers for honey.

Mastixia arborea.—This large tree produces flowers from January—May. Bees visit the flowers during morning hours for honey.

Homalium zeylanicum.—This big tree flowers from March–May. Bees visit the flowers throughout the day for pollen and more for the honey secreted by the glandular staminodes.

Casearia rubescens.—This shrubby plant produces the blossom during April–June period. Honey is stored in the flowers in a pouch formed by the filaments of stamens which cohere at their base. Bees visit the flowers during morning hours for honey.

Anthocephalus indicus.—This big tree, *Kadavala*, flowers from April–June. Bees gather pollen during morning hours.

Symplocos sp.—The tree blossoms from September–December. Bees visit the flowers till a late hour in the mornings for honey.

Vitex altissima var. *alata*.—This large tree flowers during March–May. Bees gather pollen from the flowers during morning hours.

Litsea floribunda and *L. tomentosa*.—These small trees flower during November–January. The bees gather honey and some pollen from the flowers during morning hours.

Weeds

Ammania sp.—This is a small weed commonly to be met with in coffee estates. It flowers for a long time from July–December. Bees visit the flowers for pollen during morning hours.

Bidens humilis.—This weed grows along with *Bidens pilosa*. Bees gather pollen from the flowers.

Erigeron asteroides.—This weed flowers from September till about March. Bees visit the flowers for pollen throughout the day.

Argyria hirsuta.—This plant is quite commonly found as a weed growth and it flowers during October–November. Bees are observed to enter the large flowers to suck honey secreted by the glandular hairs at the base of the stamens during morning hours.

Leucas aspera.—This (*Thumbe*) is a weed which grows luxuriously in moist places. Bees gather honey from the flowers during morning hours in the months of November–January when the plants will be in flowers.

The Amrit Mahal Cow as a Milk Animal

By

P. M. McIsaac, B.Sc. (Hons.), Ph.D.

When one speaks of the *amrit mahal* breed of cattie one usually visualizes the trotting bullock which has played a great part in the history of South India at least, if not for the rest of India. It is hardly necessary to dwell on the spirit, courage and hardiness of the noted Mysore bullock.

Can one not eulogise the cow that gives birth to these famous bullocks? Yes, then, is she only to be considered as the producer of the bullock?

Experience over a number of years with the *amrit mahal* herd at the Palace Dairy Farm, Rayankere, Mysore, shows that the *amrit mahal* cow can milk, though not to the extent of the European or the half-bred cattle. The highest daily yield given at Rayankere by an *amrit mahal* cow, No. 13–27–2, was 27 lbs. or 9 seers, without taking into consideration the milk suckled by the calf. Other cows of her breed gave somewhat less, 6, 7 and 8 seers, but the average for the *amrit mahal* milking cows, usually numbering over 20, was never less than 3 seers or 9 lbs. milk per day.

The milking capacity was, no doubt, helped by good feeding which consisted of extensive grazing, green fodder from the irrigable area, consisting of Guinea grass, maize, sunflower and jola, with hay and silage during the dry weather, and concentrated rations, composed of groundnut cake, rice bran, ragi, jola, horsegram, broken rice of local production, and wheat bran. Wheat bran was specially useful in the calving shed, for cows due to calve in about forty-five days. Purchased concentrates were fed at the rate of 3 lbs. mixture as a maintenance ration for each cow and 1 lb. mixture for every seer or 3 lbs. milk produced, the cost for the higher milking *amrit mahal* cows coming to about 5 annas each per day. There was abundant return in milk of good quality and high butter fat.

At the Cattle Breeding Station the amrit mahal cows, the only breed maintained, have not the same chance of showing their milking qualities, due to want of good feeding, as breeding of draught cattle is the main object. Dairying is carried out as a subsidiary concern, in order to have an idea of the milking ability of the cows and to meet the local demands for milk and butter. The higher yielding cows receive each, only during the dry weather, about 3 lbs. mixture, costing 1½ to 2 annas, and consisting of groundnut cake, wheat bran and rice bran, all supplies made by the contractor, ground ready for feeding, while at Rayankere all concentrates are ground at the farm, cost per pound of mixture thereby being less at Rayankere.

The only green fodder available in quantity for the cows is in the pastures during the rains. Thereafter, the only fodder available for these

cows is silage and hay. Now, in spite of the fact that there is no irrigable fodder, each of these cows, receiving less than half the rations of a Rayankere cow, can produce 2 to 3 seers of milk per day without taking into consideration the milk suckled by her calf. What would the possibility of these cows be if they were treated as dairy cows ? In all likelihood there would be among these, cows which would yield 6, 7, 8 and 9 seers of milk per day. Proof can only be furnished, however, if milking is carried out as a dairying concern.

The raiyat, however, is usually a man of small means and cannot give his cows high feeding but his milk requirements are small and he prefers the cow's calf to get the full benefit of the dam's milk. Were he or the Cattle Breeding Station prepared to feed these *amrit mahal* cows, more milk for disposal would be realised. Moreover, by a process of selective breeding these same *amrit mahal* cows will be the forbears of a type of a cattle that would be as hardy as the general *amrit mahal*, providing at once good cows for milk and good bullocks for work. The raiyat will appreciate such a type and both he and the dairy man will be benefited. If such selective breeding could be carried out for a sufficient number of years, in all probability, the type evolved would be like the original *hallikars* introduced by the Gollas or be a throw-back to the original *amrit mahal* (nectar or milk department) cows of Tippu Sultan's time.

A further advantage to the raiyat with *amrit mahal* cattle is that the animals are extremely hardy and cost of maintenance is lower than with the half-bred cattle and those foreign to Mysore State. They are able to withstand the Mysore climate and do not fall a prey to usual cattle complaints.

SELECTIONS

Peanut Meal in Livestock Production

Experimental Work

Results of experimental tests with peanut meal prove its value as a good protein feed for livestock. Numbers of experiment station specialists have carried out detailed work with it in comparison to other feeds, and have found that it stands up well under the closest scrutiny.

Peanut meal contains many of the important amino acids that give it high rank as a source of vegetable protein. These, such as lysine, tryptophane, and methionine, are all necessary for proper growth and body maintenance.

Since proteins are made up of amino acids, the value of a protein feed depends upon the kinds and amounts of amino acids composing it. The acids are what the animal uses in building up the many and varied tissues, organs, and parts of the body in growth, milk production, reproduction, and in carrying on the processes of life.

Peanut meal is fairly rich in lysine, an amino acid absolutely essential for growth. It also happens that some of the amino acids contained in the meal are the ones usually lacking in cereal grains, making the feed particularly adapted for balancing a ration composed of these ingredients.

The oil in peanut meal is also of high value. Digestion experiments have shown that it is as already digested as animal fats and is utilised, as completely. It has been shown that lack of sufficient fat or oil in the ration of dairy cows can greatly reduce the cow's efficiency for milk and butter-fat production. For this reason the high oil content of peanut meal is valuable.

Other work has demonstrated that peanut meal contains an abundance of the vitamin B complex essential for growth and health. The United States Public Health Service has determined that refined peanut meal is an excellent source of the vitamin that prevents pellagra in humans. This same vitamin prevents similar troubles in swine and other domestic animals, as indicated by work at the Pennsylvania Experiment Station.

As further proof of the value of this feed, a study by Daniels and Loughlin showed that peanuts are almost a complete food for rats. They needed only to be supplmented with vitamin A and certain minerals. Rats are not only very similar to humans in their food-requirements but also to certain domestic animals.

F. B. Morrison in his standard book, "Feeds and Feeding," says that peanut meals and feed have the following average composition and digestible nutrients:

Figures in the table show that peanut meal varies considerably in analysis. The differences are due to the grade of peanuts, the method used, and the efficiency of the manufacturing equipment. The solvent process is little used and is not of much importance in this country.

	Total Dry Matter	Dig. Protein	Total Dig. Nutrients	Nutritive Ratio	Average total consumption				
					Protein	Fat	Fibre	N. Free extract	Mineral matter
	%	%	%	1:	%	%	%	%	%
Peanut meal, old process, 45%, protein and over	94·0	41·3	83·5	1·0	46·4	8·6	9·2	24·3	5·5
Peanut meal, o.p., 43–45% protein	93·5	38·6	80·9	1·1	43·4	8·2	10·0	25·0	6·9
Peanut meal, o.p., 36–43% protein	93·0	35·9	81·8	1·3	40·3	8·6	8·3	29·2	6·6
Peanut meal, solvent ..	91·6	45·8	73·8	0·6	51·5	1·4	5·7	27·2	5·8
Peanut feed, partly hulled ..	93·5	26·8	73·1	1·7	33·2	8·7	17·7	28·2	5·7

Morrison adds that " peanut meal is one of the best protein supplements for livestock feeding".

Detailed experiments in feeding the different breeds of animals will add to the completeness of this discussion.

Dairy Cattle

For dairy cows the Virginia Experiment Station found peanut meal from eight to ten per cent. more efficient than cotton seed and soybean meals and especially desirable for supplying proteins. Likewise, in tests with dairy cattle in Delaware, the results indicted that " one pound of digestible protein in peanut meal is three per cent. more efficient for milk production than one pound of digestible protein in soybean meal".

A comparison has beeen made in Texas between peanut feed containing 38 per cent. crude protein and cottonseed meal (42 per cent. protein) showing the peanut feed superior to cottonseed meal on a basis of digestible nutrients although not on a basis of equal weights. A mixture of the two was found to be superior to either feed without the other.

The Georgia Experiment Station has found that peanut meal will produce firmer butter than some other common feeds. This effect is desirable in warm weather to counteract the softening effects of certain other feeds.

Morrison, the well-known authority on feeds, says peanut meal has proved popular where available and " furnishes protein of excellent quality for milk production, even slightly excelling cottonseed meal or soybean meal in this respect".

An interesting test was made in Georgia comparing peanut meal with cottonseed meal in a good dairy ration. The two meals were selected to be as similar in analysis as possible (peanut meal, 43·4 per cent. crude protein; cottonseed meal, 43·2 per cent. crude protein). The cows were matched as closely as possible and were fed mixtures consisting of 30 per cent. ground-shelled corn, 25 per cent. ground oats, wheat barn, and the remaining 25 per cent. as the variable: either cottonseed meal or peanut meal.

A salt and mineral mixture was added, and similar roughage was fed. Amounts of concentrates fed to each animal were regulated by the cow's appetite and were limited only to avoid marked gains in body weight. Detailed results are shown in the following table.

Comparing Peanut Meal and Cottonseed Meal for Milk Cows (Average per Cow)

	Peanut meal	Cottonseed meal
Daily milk production (lbs.)	14·46	14·02
Butter-fat test (per cent.)	4·37	4·33
Daily butter-fat production (lbs.) ..	0·632	0·607
Gain in body weight, 112 days (lbs.) ..	7·25	10·50
Daily feed consumption: Concentrates, dry matter (lbs.) ..	5·65	5·79
Roughages, dry matter (lbs.) ..	9·63	9·63

The findings reveal peanut meal to be somewhat better than cottonseed meal for the production of milk. The butter-fat test was slightly higher when peanut meal was used but the difference is probably too small to have significance. Figuring feeds at the same price—concentrates $1·50, hay 75 cents and silage 35 cents per hundredweight—and body gains at beaf prices, 5 cents per pound, the feed cost of butter-fat was 21·25 cents per pound when peanut meal was used and 22·27 cents when cottonseed meal was fed.

In another Georgia test with peanut meal fed to growing dairy heifers, results were conflicting in some respects. During the first season, growth and gains in weight were greater for the heifers not receiving the peanut meal, but during the second season, heifers receiving peanut meal did better than those that did not receive any.

Later when these heifers dropped their first calves, it was found that the calves from heifers that had received the peanut meal were noticeably stronger and larger than those from the other heifers.

Summing up all available information on peanut meal as a feed for dairy cows, it is apparent that it is one of the very best high protein feeds available for milk production. The evidence indicates that it is fully equal or possibly slightly superior to such comparable feeds as cottonseed meal and soybean meal of similar protein content. It is very palatable to cattle of all ages.

—*Bulletin* 216, *extracted from the Georgia Experiment Station, Georgia, U.S.A.*

How to Control Fleas

Fleas are troublesome pests of man and domestic animals, and certain species that infest rats and other animals carry a number of serious diseases of man, such as bubonic plague and endemic typhus or act as hosts for internal parasites.

Kinds and Habits of Fleas

There are many different kinds of fleas, but most of them have somewhat similar habits. Some confine their attacks to certain kinds of birds or animals, while others will suck blood from almost any warm-blooded animal. There are three kinds of fleas that commonly become serious pests of man in this country. These are the dog flea [*Ctenocephalides canis* (Curtis)], the cat flea [*C. felis* (Bouche)] and the human flea (*Pulex irritans* L.). In the South the stick-tight flea [*Echidnophaga gallinacea* (Westw.)] infests poultry and occasionally annoys man. The dog and cat fleas are very similar in appearance, and they feed interchangeably on dogs and cats. These are the fleas that are responsible for house invasions in the Eastern States. The human flea may live on many different animals. Often it is associated with hogs and breeds in the litter in hog houses. It also lives on dogs and cats and on wild animals, such as coyotes, badgers, and skunks. This is the flea most frequently found annoying man in the Mississippi Valley, in Texas, and westward to the Pacific Coast.

All fleas require the blood of birds or animals in order to reproduce. There is no true " sand flea " breeding in the sand without animals upon which to feed.

Stages of Development

All fleas pass through four stages, the adult, the egg, the larva or maggot, and the pupa or resting stage. The adults are found on animals or hopping about on the ground. The eggs are laid by the females while on the host and drop to the ground and hatch in a few days to the ground and hatch in a few days into legless larvæ or maggots. In 2 weeks or more the larvæ become full grown in the dust or sand and then spin tiny cocoons, in which they change to adult fleas in the course of one or more weeks.

Fleas often breed in tremendous numbers in basements or out-buildings where dogs, cats, or hogs are kept. Even when dogs, cats and other hosts are taken away, the flea maggots procced with their development, and the resulting adults may live for several weeks without food. This accounts for the frequency with which people find their homes overrun with fleas when they return from a summer vacation.

Control of Fleas on Animals

Dogs and cats can be kept practically free of fleas by occasionally applying derris or cube powder next to the skin along the back and next and on top of the head. If animals have free run, this treatment must be repeated every two weeks. A level teaspoonful is enough to kill every flea on a large dog. For smaller animals the amount should be reduced according to the size of the animal. Most derris and cube powders are effective. Their insect-killing value depends largely upon the amount of rotenone they contain. They should have at least 0·5 per cent. of rotenone and should be finely ground. Much of the powder now on the market contains 4 or 5 per cent. of rotenone. This may be diluted with talcum powder

so as to bring the rotenone content down to 1 per cent. These materials kill slowly; do not expect to see the fleas drop off dead immediately after an application.

If derris or cube is not at hand fresh finely ground pyrethrum powder (insect powder) may be used as a dust. Pyrethrum powder should contain not less than 0·9 per cent. of pyrethrins; these are the insecticidal principles of pyrethrum.

None of these materials is considered poisonous to domestic animals, although cats are sometimes thrown off their feed by licking the material from the coat. As the eyes are sensitive to derris and cube, care should be taken not to get these powders into them.

In areas where the human flea abounds, in addition to treating the dogs and cats as outlined above, hogs should be kept from barns and from going beneath houses. Their backs should be lightly sprinkled with crankcase oil or crude petroleum every 2 or 3 weeks. If fleas are properly controlled on animals house and yard infestations will be avoided.

Destroying Fleas in Houses and Out-buildings

Fleas in houses and barns originate in the sleeping places of animals. If these are in cellars, in outbuildings, or beneath buildings or porches, spraying the infested areas with creosote oil with a good force pump is most satisfactory. A compressed—air sprayer, or better a bucket pump, with a lead of high-pressure with tight connections, should be used.

Creosote oil will burn animals and plants. It has an objectionable odour and will stain. Therefore it cannot be used in every situation. It is not necessary to spray the walls of a cellar or outbuilding. Creosote oil is relatively cheap (50 cents to $1 per gallon) and is generally available, since it is commonly used as a wood preserver. It is remarkably effective against fleas. Usually one light spraying will wipe out an infestation. One-half gallon is sufficient for 1,000 square feet of floor surface. More is required for dirt floors with cracks or where much dust or litter is present.

When fleas are found to be breeding in hogpens or barns, the litter should be raked up and scattered on fields, or burned, before the spray is applied or after a preliminary spraying to give relief while cleaning up.

If fleas are abundant in living quarters, scatter flaked naphthalene over the floor of each infested room at the rate of 5 pounds per room. Keep the room closed for 48 hours. The remaining naphthalene crystals may be swept up and put in a tight container for future use. If animals have been sleeping on over stuffed furniture it also should be covered with the naphthalene.

In cases where the main trouble is in the basement, the creosote oil spray applied there will usually give immediate relief. The scattered fleas carried into the living rooms may be destroyed with a commercial fly spray applied with an atomizer. The fleas must be hit by the spray.

As soon as the premises have been treated as described, the treatment of the dogs and cats with derris or cube powder should be begun.

Occasionally fleas will spread from infested outbuildings or basements to the yard and lawn. Treatment of the breeding places and keeping the lawn closely cut will usually meet this situation. Fleas do not live long when exposed to sunshine and rains. If fleas persist in lawns or gardens, the grass and ground should

be thoroughly sprayed with 1 part of nicotine sulfate in 150 parts of warm water (about 6 teaspoonfuls to 1 gallon), with enough soap added to make the water milky.

Prevention of house infestations by keeping fleas off animals is not difficult, and pets are much relieved if they are kept free of fleas.

Stick tight Flea Control

Sticktight or chiken fleas are often troublesome in the South. They infest poultry, cats, dogs, rats, and other animals and annoy man. The adult fleas attack the heads of their host principally and remain attached for weeks without changing position. The edges of the ears of dogs and cats are often covered with them.

These fleas can be controlled by keeping the roosting and nesting places of poultry clean and by spraying the dropping boards, nests, and floor of the chicken house with creosote oil. Fowls should be kept from beneath buildings, or such places should be sprayed with creosote oil every 2 or 3 weeks. If this is done, treatment of the fowls is not necessary. Derris or cube powder or carbolated vaseline will kill the fleas. When derris or cube is applied to dogs and cats to control this flea, it must be brought in contact with the insects, as the sticktights do not move around and come in contact with the powder.

Where Insecticides may be Obtained

Derris or cube powder, or proprietary powders containing extracts of these materials and pyrethrum powder are available in many drug, seed, pet-animal and other stores. Naphthalene flakes are handled by drug stores. Creosote oil is sold by many dealers in paint, hardware, and lumber. The market price of derris varies with the available supply and the amount purchased, but it usually sells at wholesale for about 20 to 50 cents a pound for powder containing from 4 to 5 per cent. of rotenone.

—*Leaflet No.* 152, *U. S. Department of Agriculture.*

The Biology of the Tropical Cattle Tick and Other Species of Tick in Puerto Rico, with Notes on the Effects on Ticks of Arsenical Dips

Summary

The tropical cattle tick (*Boophilus annulatus microplus* Can.) is of importance not only because of the irritation caused and debilitating effect on the host animal but because it is a natural agent of dissemination of splenetic or tick fever of cattle. It is widely distributed throughout South America, Central America, and Mexico, as well as in the islands of the West Indies and in Borneo, Sumatra, and the Philippine Islands. In the United States, although formerly occurring in several countries in Florida and over a smaller area in Texas it has now been eradicated from all except the extreme southern portions of these two States.

The facts that this variety and the cattle tick (*Boophilus annulatus* Say) do not commonly attack wild animals and that the cattle tick has been largely eradicated from the United States indicated the feasibility of eradicating the tropical variety

from Puerto Rico. The biology under Puerto Rican conditions was therefore investigated as a basis for eradication work, and the results of studies in 1936-1937 and 1938 are given in this paper.

Ticks in their non-parasitic periods were studied in bottomless glass tubes set in the soil, and those in their parasitic periods, as attached to host animals confined in isolated stalls.

The pre-oviposition period ranged from 2 to 6 days, the oviposition period from 11 to 18 days, and the minimum incubation period, under different climatic conditions, from 18 to 76 days.

There was no marked seasonal variation in larval longevity of *Boophilus annulatus microplus* in Puerto Rico. Larval longevity in the dry southern coastal region and in the higher altitudes of the interior, where there is a comparatively high rainfall, however, ranged from 65 to 184 days; and the total non-parasitic period, or the period from the dropping of the engorged female to the death of the last larva, ranged from 89 to 251 days.

The larvæ began to molt from the seventh to the twelfth day after their application to a bovine host. Nymphs completed engorgement 12 to 26 days after attachment, or 5 to 17 days after the larval molt. The period from the nymphal molt to the dropping of the engorged female, or the adult stage, ranged from 5 to 23 days. The minimum period from attachment of the larva to the dropping of the engorged female was 18 days, and the maximum period was 37 days.

The life-cycle, including both parasitic and non-parasitic development, may be completed in Puerto Rico on cattle within a minimum period of approximately 41 days; the maximum may extend over a period of approximately 300 days. The minimum parasitic period of *Boophilus annulatus microplus* on goats, sheep and dogs was found to be practically the same as that on cattle.

The tropical cattle tick was taken from goats, sheep, and horses in considerable numbers under natural conditions. Host records definitely indicate that these animals should be taken into account in a cattle tick eradication campaign in Puerto Rico. In Puerto Rico, dogs, hogs, and mammals other than the above apparently are of little or no importance as natural hosts of the cattle tick.

In addition to *Boophilus annulatus microplus* two other species of ticks commonly occur in Puerto Rico and are of widespread economic importance, *viz.*, the tropical horse tick (*Dermacentor mitens*) and the brown dog tick (*Rhipicephalus sanguineus*).

No parasites of the tropical cattle tick were found. However, a high degree of parasitization by the hymenopterous parasite (*Hunterellus hookeri*) was encountered among nymphs of the brown dog tick.

Standard arsenical dips, such as are used in the continental United States, proved to be effective in destroying the tropical cattle tick in Puerto Rico, practically all the animals being free of engorged female ticks after the second or third dipping. The arsenical dip was also effective against the tropical horse tick but considerably greater care was necessary in dipping horses to insure that the solution came in contact with all the ticks on the animal.

—*The Journal of Agriculture of the University of Puerto Rico*, Vol. 25, No. 1.

List of Publications with Important Contents received at the Mysore Agricultural and Experimental Union

June-December 1941

(For Member's Reference)

The Tropical Agriculturist, Ceylon,

Vol. 97, No. 1, July 1941—

The Effect of Measuring Cocoanut Palms on the Oil and Protein Contents of the Copra. *Reginald Child and M. L. M. Salgado* .. (55)

Cultural Experiments with Turmeric. *W. R. C. Paul and M. Fernando* .. .. (47)

Some Results of Harrowing a Growing Rice Crop. *G. V. Wickramasekhara* .. .. (46)

A Virus Disease of *Emilea scubra*. *C. A. Loos* .. .. (15)

Report on the Work in Progress in the Chemical Division of the Department of Agriculture .. .. (1)

Rational Farming Scheme, Kurandakkulan, North Central Province (25, 6)

Bulsa Wood ... . (44)

Industrial Uses of Cashew and Its Products (*Selection*) .. (30)

Mixed or Multiple Cropping in Native Agricultural Practice (*Selection*) .. .. (6)

Lime and Liming (*Selection*) .. .. (11)

Vol. 97, No. 2, August 1941—

Leaf-Spot Disease of Lettuce and Antirrhium. *T. E. T. Bond* .. (39)

The Potash Content of Cocoanut Husks and Husk-ash. *M. L. M. Salgado and E. Chinnarasa* .. .. .. (55)

The Nitrogen Content of Ceylon Rain. *D. E. V. Koch* .. (11, 3)

The Seed Fat of *Garcinia echinocarpa* Thwaites ('Madol Oil'). *Reginald Child and Wilfred R. N. Nathanel* .. .. (52)

Jams and Jellies from Ceylon Fruits .. .. .. (39)

Tung Oil: Trials in Ceylon .. .. (44)

A Method of Compost-making Used in Nyasaland (*Selection*) .. (11)

The Manufacture of Dried Banana Products (*Selection*) .. (39)

The Mysore Economic Journal, April 1941—

Raiyatwari Proprietory Holders in Bombay—I. *M. B. Ghatge and L. H. Mirajkar* .. .. .. (25)

May 1941—

Raiyatwari Proprietory Holders in Bombay—II. *M. B. Ghatge and L. H. Mirajkar* .. .. .. (25)

The Size of a Sugar Factory in India. *V. R. Rao* .. (25, 49)

June 1941—

Agriculture in the Frontier. *'A.H.K.'* .. .. .. (25)

July 1941—
Indian Groundnut Oil (*Selection*) .. .. .. (52)
December 1941—
Indian Rice Crop. *A. C. Gupta* .. .. .. (46)

The Madras Journal of Co-operation, July 1941—
Tiruppur Cattle and Pony Show .. .. .. (30)
August 1941—
War has Revived our Rural Industries. *Sydney Moorehouse* .. (25)
Education for Rural Life. *Edwin E. Embrace* .. .. (23)
September 1941—
Problems of Agricultural Co-operation in Madras .. .. (23)

The Indian Veterinary Journal, Vol. 18, No. 1, July 1941—
Canine Nutritional Deficiency Diseases. *L. D. Frederick and H. E. Robinson* .. .. (37)
Some Diseases of the Ears of Dogs. *H. C. Stephenson* .. .. (37)
Care of Horn. *T. N. Kulkarni* .. .. (30)
Malpractice of Phooka and Its Consequences. *D. B. Khole* .. (30)
Breech Presentation of a Megalocephalus Monster in a Cow .. (30)
Cæsarian Section in a Bitch .. .. (37)
A Case of Multiple Hydatid Cysts in the Internal Organs of a Cow .. (30)
Clinical Aspect of Anthrax and Hæmhorrhagic Septicæmia as Met with under Village Conditions .. .. .. (30)
A Case of Avian Tuberculosis .. .. (31)
Treatment of Osleoporosis in Horses .. .. .. (31)
Azoturia .. .. (30)
Treatment of Moist Eczema by Subcutaneous Injections of Sterile Cow's Milk .. .. (30)
Worm in the Anterior Chamber of the Eye of a Bullock .. .. (30)
Milk Fever .. .. (30)
Tobacco Poisoning in a Calf .. .. (30)
A Simple and Practical Test for the Diagnosis of Osteoporosis in Horses (*Extract*) .. .. (31)
Immunising Value of the Blood Clot of Hyperimmunised Animals (*Extract*) .. .. (30)
Stiff Lamb Disease (Aphosphorosis) (*Extract*) .. .. (30)
Vol. 18, No. 2, September 1941—
Experiment in Trypanosoma Evansi. *A. R. Kuppusamy* .. (30)
Flies and Their Control in Cattle Farms and Dairies. *N. S. Shankaranarayana* .. .. (30)
Bovine Trypanosomiasis .. .. (30)
Spirocerca Sanginolenta in a Bitch .. .. .. (37)
Fowlpox .. .. (32)
Successful Treatment of Newly Born Heifer-Calf with Shark Liver Oil for Vitamin Deficiency .. .. (30)
Sarcoporodiasis in Cattle .. .. (30)
Facial Paralysis in a Bullock .. .. (30)

A Peculiar Case of Calcium Deficiency in a Cow .. .. (30)
Undiagnosed Skin Disease in Horses .. .. .. (31)
Can this be *P. Gibsonii?* .. .. (30)
Should Cross-bred Bulls be Used for Breeding? .. ..
Example from Other Countries. *M. Crawford* (*Extract*) .. (30)
Vol. 18, No. 3, November 1941—
Phenothiazine—A Remarkable Efficient Anthelmentic. *E. L. Taylor and K. M. Sanderson* .. .. .. (30)
Cattle Poisoning by *Sorghum vulgare. K. N. Bagchi and H. D. Ganguli* .. .. (30)
The Treatment of Bovine Mastitis .. .. .. (30)
Distemper .. .. (30)
Mange .. .. (30)
Cutaneous Microfilaria .. .. (30)
Epistaxis—Treatment with Oxalic Acid .. .. .. (30)
Compound Fracture of the Metatarsal in a Dog .. .. (37)
A Case of Hermophrodite Transversalis Feminus in a Calf with Imperforate Anus .. .. (30)
Nasal Schistomiasis in Goats (*Abstract*) .. .. .. (36)
Riboflavin Deficiency in Poultry (*Abstract*) .. .. (32)
The Influence of Oophorectomy on the Performance of Grey Hound Bitches (*Abstract*) .. .. (37)
Smuggling Opium and Charas in the Stomachs of Camels (*Extract*) .. .. (37, 13)
Control of Hæmorrhage by Intravenous Use of Oxalic Acid (*Extract*) (30)
Milk—The Perfect Food (*Extract*) .. .. .. (29)

The Madras Agricultural Journal, Vol. 29, No. 6, June 1941—
Banana Figs and Banana Flour with Special Reference to Madras Varieties. *K. Cherian Jacob* .. .. (39)
Distribution of Paddy Varieties in Palghat Taluk. *M. Balakrishna Nair* (46)
The Nizam Sugar Factory Plantation. *S. Krishnanda Sastry* .. (49)
Economic Factors in Agricultural Development (*Selection*) .. (25)
Emasculation in Chilli .. .. (39)
Control of Lantana by a Sodium Chlorate Spray .. .. (8)
Does Fertilizer Affect the Arrowing of Cane? .. .. (49)
Sheep Breeding Research in India .. .. .. (33)
Eleven Years' Results of Continuous Manuring of Paddy at Mandalay (46)
The Effect of Pruning at Varying Ages Upon the Yield of 'Ramai Rice' .. .. (46)
Vol. 29, No. 7, July 1941—
An Economic Survey of the Anakapalle Jaggery Market. *A. Sankaram* .. .. (49, 24)
Cropping Behaviour in Mangoes. *K. C. Naik and M. Mohan Rao* .. (39)
A Brief Account of the Studies on the Harmful After-Effects of Cholum Crop on Cotton .. .. .. (6, 41)
Composition of the Alcohol Extract of Sugarcane Leaves as a Means of Determining Soil Fertility .. .. (11, 49)

Vol. 29, No. 8, August 1941—
Fruit Nursery Practices. *V. Venkatareddi and R. Shanmuga Sundaram* .. .. (39)
Some Fruit Tree Diseases in Relation to Horticultural Practices and Mineral Deficiencies. *Desai Narayana Rao* .. .. (39)
Plant Breeding and Genitical Work in India. *K. Ramiah* (*Selection*) (10)
Save Your Tomato Seed—Getting and Preserving the Seed .. (39)
A New Species of Coleus .. .. (39)
Stimulation of Root Formation of Sugarcane by Ethyl Alcohol .. (49)
Vol. 29, No. 9, September 1941—
Nagari Oranges—Their Past and Present. *A. Muhammad Ali* .. (39)
Some Promising Fruit Products of South India. *R. Shanmuka Sundaram and D. Krishnaswami Naidu* .. (39)
Preliminary Studies on the Cardamom Thrips (*Taeniothrips cardmomi* Ramk.) and Its Control. *M. C. Cherian and M. S. Kylasam* .. (53)
A Short Note on Dry-land Paddy in Udayarpalyam. *T. V. Ayyaswami Iyer* .. .. (46)
Importance of Fruit Products Industry in India .. .. (39)
Carbonised Citrus Fruit Beverages .. .. .. (39)
The Effects of Fertilising Both the Seed Bed and the Field Upon the Yield of Elon-elon Rice .. .. (46)
India's Cashewnut Trade in America .. .. .. (39)
Edible Syrups from Molasses .. .. (49)
Vol. 29, No. 10, October 1941—
Some Noteworthy Features of Fruit Industry in Rajampet Taluk. *T. R. Viswanathan* .. .. (39)
A Note on Marketing of Cotton in the Regulated Cotton Markets of Berar and Bombay Presidency. *M. Jeevan Rao* .. .. (42)
Cultivation and Marketing of Virginia Tobacco. *K. Shankariah* .. (56)
A Note on Concentrated Seed-beds and Double Transplanting of Paddy in the Nellore District. *A. Gopalkrishna Naidu* .. (46)
Cinchona in the British Empire .. .. (53)
Increasing the Feeding Value of Cereal Straws .. .. (45)
The Effect of Inter-row Tillage on the Yield of Potatoes .. (47)
Sources of Tobacco Diseases .. .. (56)
Grass-Seeding by Air Plane .. .. (40)
Minor Elements in Sewage .. .. (11)
Vol. 29, No. 11, November 1941—
Rose Growing. *S. Sundararaman* .. .. .. (39)
Culture of Oranges at Kodur. *Mohan Rao* .. .. .. (39)
The Artisan's Share in Agricultural Production. *M. Balakrishna Nair* .. .. (23)
The Status and Study of the Insect Group, 'Thysanoptera' in India. *T. V. Ramakrishna Iyer* .. .. (16)
Silage from Sugarcane Tops .. .. .. (49, 28)
Preparation of Cocoanut Shell Charcoal .. .. .. (55)
The 'Topato' .. .. (39)
A New Method of Plant Propagation .. .. .. (10)

Chemical Lures for Insect Pests .. .. .. (17)
Sun's Rays for Cooking Food .. .. .. (14, 21)
Time Spent by Honey-bees for Collecting Pollen and Nectar .. (34)
Chinese Hand-power Groundnut Decarticator .. (20, 52)

The Nagpur Agricultural College Magazine, Vol. 15, No. 4, June 1941—
Canning and Bottling Fruits and Vegetables. *V. G. Vaidya* .. (39)
Wounds. *S. K. Dighe* .. .. (30)
The Improvement of Cotton Varieties in India (*Extract*) .. (41)
Meek-Gregory Report—American Market for Indian Manufactures .. (24)
Control of Contagious Mastitis .. .. (30)
Vol. 16, No. 1, August 1941—
Estimation of Yield of Cotton by Sampling. *Dhannalal* .. (41)
Gram Vidhan or Village Planning. *V. C. Mehta* .. .. (23)
Silage from Sugarcane Tops .. .. .. (28, 49)
Poisoning 'weed trees' and undergrowth .. .. .. (8)
The Topato .. .. (39)
Indian Vegetable Oil as Fuel for Deisal Engines .. (20, 52)
Brief Descriptions of the Principal Indian Breeds of Cattle, Their Homes and Their Characteristics (*Selection*) .. .. (30)
The Nature of Chemical Weathering of Trap Rock in Nagpur. *K. G. Joshi* .. .. (11)
A Study of the Family Budgets of Six Tenant Families of Village Dhammaria. *S. L. Patni* .. .. (21)
Soil Conservation: Soil Erosion and Some Measures for Its Control. *M. N. Pathankar* .. .. (4)
Artificial Insemination. *M. Ganpatrao* .. .. .. (30)
Cultivation of Berseem or Clover (*Trifolium Alexandrium*) and Its Cost of Cultivation on the College Farm. *Dhannalal* .. (40)
Brief Descriptions of Principal Indian Breeds of Cattle .. .. (30)

Indian Farming, Vol. II, No. 4, April 1941—
The Fourth All-India Cattle Show .. .. .. (30)
Jams, Jellies and Marmalades from Punjab Fruits. *Lal Singh and Giridhari Lal* .. .. (39)
Farming After the War. *The Rt.-Hon'ble Lord Addison* .. (25)
Gujrat Roller. *Main Mukhtar Nabi, Nek Alam and Lala Nathu Ram* (20)
Some Common Breeds of Indian Sheep. *R. L. Kaura* .. .. (33)
Plant Hormones. *W. W. Mayne* .. .. .. (10)
Cotton in the Chittagong Hill Tracts. *M. P. Singh* .. .. (41)
The Royal Agricultural and Horticultural Society of India. *S. Percy-Lancaster* .. .. (1)
Dairying and Rural Improvement. *Roshan Lal Tandon* (27, 25)
Guinea Grass as Fodder .. .. (40)
Pyrilla in the Deccan .. .. (16)
Veterinary Work in the North-West Frontier Province. *M. Abdul Wahid Khan* .. .. (30)
Bacterial Ring Rot Threat .. .. (47)
Citrus Trees .. .. (39)

Food Colours .. .. (14)
Ram Grading Service .. .. (33)
Diseases of the Pig and Its Husbandry. *David J. Anthony* .. (35)
Soil-less Culture Simplified. *Alex Laurie* .. .. .. (11)
Ipecacuanha .. .. (57)
Vol. II, No. 5, May 1941—
Central Herd Books for Indian Dairy Breeds .. .. (30)
The Development of the Canning Industry in India. *Lewis Jose De Souza* .. .. (39)
Cattle-Keeping as the Centre of the Farm-Organism. Condensed and Translated by *G. T. Wrench* .. .. (27)
The San Jose Scale and Its Control in Kashmir. *M. R. Fotidar* (16, 17)
Household Insect Pests and Their Control. *Mohan Singh* (16, 17)
Propagation of the Apple in Kumaun. *R. S. Singh* .. .. (39)
Farming After the War .. .. (25)
Rural Reconstruction in Sind. *Abdul Nabi Gul Hassan Khan Agha* (25)
Plant and Animal Nutrition .. .. .. (12, 30)
Recent Reorganisation and Research in the Malayan Pineapple Canning Industry. *W. J. B. Johnson* .. .. .. (39)
Opium in Camels' Stomachs .. .. .. (14, 30)
Vol. II, No. 6, June 1941—
Look to the Land .. .. (25)
The Use of Town Wastes as a War Measure. *G. T. Wrench* (11, 13)
Livestock Industry in India. *K. C. Sen and T. S. Krishnan* .. (30)
The Lucknow Co-operative Milk Supply Union. *W. L. Davies* .. (29)
Disposal of Molasses and Sugar Factory Effluents. *H. D. Sen* .. (49)
Bigger Legume Yields from Inoculated Seeds. *M. R. Madhok* .. (48)
Drying of Vegetables. *Lal Singh and Giridhari Lal* .. .. (39)
Transmission of Rinderpest .. .. (30)
Jute Research .. .. (51)
Foul Spirochætosis in India .. .. (32)
Cattle in Cochin. *M. Sankara Menon* .. .. .. (30)
Soybean Pioneer. *Don Wharton* .. .. .. (48)
The Care of Bulls .. .. (30)
Fertility of Tobacco Soils .. .. (56)
Soil Development .. .. (4)
Household Fly .. .. (16)
Vol. II, No. 7, July 1941—
The First Cereal .. .. (45)
Ranikhet Disease: The Present Position. *J. R. Haddow* .. (32)
Paddy Growing in Coorg. *A. C. Thimmiah* .. .. (46)
Science Tones up Culture .. .. (1)
Tinned Milk. *W. L. Davies* .. .. (29)
Cultivated and the Wild Plants. *T. S. Venkatraman* .. .. (9)
The Monsoon of 1940. *K. R. Ramanathan* .. .. .. (3)
Agricultural Improvement Means Agricultural Education .. (23)
Mushroom Cultivation in India. *G. Watts Padwick* .. .. (39)

Agriculture in Ajmer-Merwara. *Rao Bahadur V. A. Tamhane* .. (25)
Vaccination against Ranikhet Disease .. .. .. (32)
Hosur Sind Herd .. .. (30)
Experimental Hand Plough .. .. (20)
Soil Erosion .. .. (4)
How Plant-Breeder Aids Crops .. .. (10)
Bull Pens and Exercising Yards .. .. .. (30)
Maturity of Tobacco .. .. (56)
Windbreaks Mean Trees .. .. (44)

Vol. II, No. 8, August 1941—

Indian Cattle in Other Countries .. .. .. (30)
The Codling Moth and Its Control. *S. C. Roy* .. (16, 17)
Marketing of Eggs and Egg Products. *A. J. Macdonald* .. (32)
Utilization of Inferior Grades of Citrus Fruit. *N. N. Chopra* .. (39)
Peace and War Objectives of British Agriculture .. .. (25)
Pyrethrum in Kashmir. *M. R. Fotidar* .. .. (39, 17)
Solar Treatment of Wheat Loose Smut. *J. C. Luthra* .. .. (43)
The Breed is Greater than the Breeder. *E. Walford Lloyd* (10, 30)
Insect Study and Animal Disease Control. *B. C. Basu* .. .. (30)
Rural Reconstruction in Hyderabad. *Raziuddin Ahmad* .. (25)
Seed Treatment and Crop Out-turn .. .. .. (7)
Edible Syrups from Molasses .. .. (49)
Control of Ticks in Bombay. *R. N. Naik* .. .. .. (30)
Utilizing Soybeans .. .. (48)
Breeding Ewes .. .. (33)
Care of Colts .. .. (31)
Sources of Tobacco Diseases .. .. (56)
Feeding of Dairy Cows .. .. (30)
Creep Feed the Litter .. .. (35)

Vol. II, No. 9, September 1941—

Animal Production during the War—And After .. .. (30)
The Soybean—Its Politics, Performances and Possibilities. *W. Burns* (48)
Animal Husbandry in Ancient India—I. *A. Krishnaswamy* .. (30)
Drying of Fruits and Vegetables. *Khan Mohd. Aslam Khan* .. (39)
Cotton Jassids and their Control. *K. B. Lal* .. .. (41)
Lablab—The Garden Bean. *G. N. Rangaswami Iyengar and K. Kunhi Krishnan Nambiar* .. .. .. (48)
Possibilities of Six-Anna Ducks. *R. C. Woodford* .. .. (32)
Agricultural Development in Jhalawar. *Kunwar Narain Singh Mathur* (25)
Nutrition of Chickens .. .. (32)
Jute Spinning Trails .. .. (51)
Veterinarians in National Economics .. .. (25, 30)
Greenhouse Pests Control .. .. (39)
Minerals for Hogs .. .. (35)
Machinery During Winter .. .. (20)
Bombing Effects on Livestock .. .. (30)
Honey .. .. (34)

Vol. II, No. 10, October 1941—

Farmers and Forests. *S. H. Howard* .. .. .. (44)
The Desert Edge of Indian Agriculture. *W. Burns* .. (6, 25)
Science is not a Thing Apart .. .. (1)
Reclamation of Usar Lands at Bilanda. *Bishan Mansingh* .. (4)
Secret Bidding in the Cotton Trade. *P. L. Tandon and Fazlal Haq* (41)
Improved Ghee-making for Villagers. *Y. M. Parnerkar* .. (29)
Green Manuring. *R. D. Rege* .. .. (11)
Potatoes in the Simla Hills. *Pushkar Nath* .. .. (47)
Animal Husbandry in Ancient India—II. *A. Krishnaswami* .. (30)
Fired Soil as Fertilizer .. .. (11)
Fowl Spirochætosis in India .. .. (32)
Soybeans: A Protein Feed .. .. (48)
Vitamin Needs of Swine .. .. (35)
Indian Wools and Goatskins .. .. .. (33, 35)
Milk Trees .. .. (44)
Fruit Census .. .. (39)
Guarding Britain's Cornfields .. .. (25)

Vol. II, No. 11, November 1941—

Indian Fisheries and the War .. .. (37)
Rural Reconstruction with a Difference. *W. Burns* .. .. (25)
The Storage and Transport of Foodstuffs. *D. V. Karmarkar* (20, 22)
Cattle of the Kosi Region in Bihar. *H. R. Kapur and R. K. Ram* .. (30)
Rice in the Travancore Backwater Reclamations.
K. R. Narayana Iyer .. .. (46)
The Locust Menace in Sind. *L. M. Hira* .. .. .. (16)
Sewage Sludge as a Starter for Compost. *F. C. Griffin* .. .. (11)
Manuring of Mango Trees: The Present Position. *S. C. Roy* .. (39)
Animal Husbandry in Ancient India—III. *A. Krishnaswami* .. (30)
Cotton Stem Weevil .. .. (41)
Groundnut as Human Food .. .. (52)
What is Research? .. .. (1)
Cattle for Exhibition .. .. (30)
Rabbit for Meat and Fur .. .. (37)
Bonemeal in Dairy Ration .. .. (30)
Worms in Pigs .. .. (35)
Indian Canes Abroad .. .. (49)
Moles Help War Effort .. .. (1)
Thousand-Year-Old Cattle .. .. (30)
Restaurant Straws .. .. (39)

Vol. II, No. 12, December 1941—

India's Millions and the Food Cycle. *Gilbert J. Fowler* .. .. (22)
Tharparkar and Thari Cattle. *F. Ware* .. .. .. (30)
Storage of Potatoes. *P. L. Tandon and Partap Singh* .. .. (48)
The Young Farmers Club. *S. M. Huda* .. .. .. (23)
Indian Sugar during the Last Decade. *M. P. Gandhi* .. .. (49)

A Pole for Carrying Heavy Loads. *V. M. Chavan and V. G. Indulkar* .. .. (20)
Why Cattle Need Minerals. *P. Venkataramiah* .. .. (30)
Hiving *Apis indica* Colonies. *Thakur Jagadish Narayan Singh* .. (34)
The Monsoon of 1941. *C. Ramaswamy* .. .. .. (3)
Cold Storage of Pears .. .. (39)
Linseed Research .. .. (52)
Madras Fisheries .. .. (37)
Decline in American Agriculture .. .. .. (25)
Jamnagar Bajra .. .. (45)
Jam from Powder—Apples .. .. (39)
No. 789. Supply Responses in Milk Production in Southern Minnesota. *Edwin G. Strand and Erling Hole* .. .. (29)
No. 791. Hibernation of the Corn Earworm in South-eastern Georgia. *G. W. Barber* .. .. (42)
No. 800. The Effect of Pasteurisation on Some Constituents and Properties of Goat's Milk. *H. S. Haller, C. J. Babcock and N. R. Ellis* .. .. (36, 29)
U.S.D.A. Farmer's Bulletins—
No. 1884. The Sugarcane Borer .. .. (49)
U.S.D.A. Circulars—
No. 613 (September 1941). Studies on the Respiration of Strawberry and Raspberry Fruits. *Mark H. Haller, Dean H. Rose and Paul L. Harding* .. .. (39)
No. 619 (September 1941). Preservation of Fruits and Vegetables by Commercial Dehydration. *G. M. Chace, W. A. Noel and V. A. Pease* (39)
U.S.D.A. Leaflets—
No. 104. Crested Wheat Grass .. .. (40)
No. 210. Pricklypear Control .. .. (8)
No. 211. Cotton from Boll to Bale .. .. .. (41)
Georgia Experiment Station—
Fifty-third Annual Report—1940–41 .. .. .. (1)
Circular 131 (Nov. 1941). Cultural Methods for Growing Peanuts. *U. R. Gore* .. .. (52)
Bulletin 218. Better Methods of Pimento Production. *H. L. Cochran* (39)
Department of Agriculture, Bombay—
Crops Estimates: Groundnut and Sesamum, 1941–42 Season .. (52)
The Mysore Co-operative Journal, Vol. 17, No. 11 (Nov. 1941)—
Co-operation and Rural Reconstruction in Mysore .. (23, 25)
International Co-operators' Day .. .. .. (23, 25)
The Mysore Economic Journal, Vol. 28, No. 1, January 1942—
The Indian Village—Then and Now. *The Editor* .. .. (23)
Some Misconceptions about Random Sampling. *Amar Narayan Agarwala* .. .. (2)
Development of Wool Production. *C. T. Rao* .. .. (33)
Wool Spinning in Mysore. *Ram Gupta* .. .. .. (33)
Vol. 28, No. 2, February 1942—
Land Mortgage Banks in Mysore. *C. S. Kuppuswamy Iyengar* .. (25)

The Madras Agricultural Journal, Vol. 30, No. 1, January 1942—
Mixed Cropping—A Review. *G. N. Rangaswamy Iyengar and M. A. Shankara Iyer* .. .. (6)
Our Present Position with regard to the Control of Fruit Pests. *M. C. Cherian* .. .. (39)
Why Cattle Need Minerals. *P. Venkataramiah (Selection)* .. (30)
Age-Fertiliser Effects on the Physiology and Chemistry of Sugarcane. .. .. (49)
Significant Roles of Trace-Elements in the Nutrition of Plants .. (12)
Tannin from Kernels of Green Betelnuts .. .. .. (53)
The Poona Agricultural College Magazine, Vol. 33, No. 3, December 1941—
Groundnut Cake as a Cheap and Useful Cattle Food. *E. J. Bruen* (30, 52)
Progress of Plant Pathological Research in Bombay. *M. N. Kamat* (15)
All about Indian Sugar in Brief. *D. G. Kulkarni* .. .. (49)
The Poona Sewage and Its Utilisation as Manure. *D. G. Kulkarni* (11)
Arborday Afforestation Programmes. *S. T. Banasode* .. .. (44)
Poultry-Keeping for Farmers. *Hussain Talib* .. .. (32)
A Note on Effects of Heavy Rain in Some Localities of the Surat District. *A. A. Vasavada* .. .. (4)
Successful Erosion Control Grasses .. .. .. (4)
Internal Parasites in Animals .. .. .. (30)
Kisan, Hindi Monthly for January 1942.
The Madras Journal of Agricultural Co-operation, Vol. 33, No. 6, Dec. 1941—
The Madras Village Panchayats' Bill. *R. Suryanarayana Rao* .. (25)
Co-operative Farming. *P. Subba Reddi* .. .. .. (23)
Vol. 33, No. 7, January 1942.
Industry, Vol. 32, No. 382, January 1942—
Manufacture of Dehydrated Potatoes .. .. .. (47)
Manufacture of Citric Acid from Limes .. .. .. (39)
Manufacture of Malted Food .. .. (14)
Manufacture of Unfermented Apple Juice .. .. .. (39)
Wool Bleeching and Dyeing .. .. (33)
Indian Farming—
The Poultry Industry and the War .. .. .. (32)
Canned Poultry. *A. J. Macdonald* .. .. .. (32)
Campaigns against Sugarcane Pests. *H. G. Sadik and Dalbir Singh* (49)
Hints to the Jute Grower. *A. S. Gilles* .. .. .. (51)
Experiences of an Amateur Farmer. *C. H. Parsons* .. .. (23)
Crop Cutting Experiments. *S. Subramania Iyer* .. .. (2)
Extraction and Preservation of Rock-bee Honey. *M. C. Cherian and S. Ramachandran* .. .. (34)
Studies on the Ripening of Plums. *Lal Singh and Abdul Hamid* .. (39)
Preparation and Maintenance of Lawns. *L. S. S. Kumar* .. (40)
Ox Warble-fly Control .. .. (30)
Eri and Tassor Worms—Green Potatoes—Hopplant—Marking Animals .. .. (30, 38, 39, 47)
Locust Control .. .. (16)

The Weeping Willow as a Fodder Tree .. .. (40, 44)
The Kudzu Vine—Oldest Bovine in India .. .. (30, 39)
U.S.D.A.—
Index to Farmers' Bulletins Nos. 1501–1750 .. .. (1)
The Review of Applied Entomology—
Series A—Agricultural: Vol. 28, Title-page and Index .. (16)
Series B—Medical and Veterinary: Vol. 29, Part 9, pp. 137–152, September 1941 .. .. (16)
The South African Sugar Journal,
Vol. 25, No. 11, November 1941—
Plastics from Bagasse. *O. W. Wilcox* .. .. .. (49)
Red rot in Co 290 Cane. *H. H. Dodds* .. .. .. (49)
In Defence of Sucrose. *H. L. Stubbs* .. .. .. (49)
Vol. 25, No. 12, December 1941—
The Queensland Cane Cutter. *Duglas Mummary* .. .. (49)
Nature and Man. *John Fisher* .. .. (1)
Experiment Station Notes Co 301 and Co 290 .. .. (49)
New Zealand Journal of Agriculture,
Vol. 63, No. 5, November 1941—
Black Leg in Sheep. *M. B. Buddle* .. .. .. (33)
The White Butterfly and the Diamond-beaked Moth. *J. Muqqeridge and B. B. Given* .. .. .. (16)
Milking Machine—The Pulsator. *W. G. Whittleston* .. (20, 39)
Congenital Goitre in Lambs. *C. V. Dayes, B. A. Taylor and G. A. Thompson* .. .. (33)
Farm Management under Irrigation. *A. A. Copland* .. .. (6)
Arable Crops for Sheep is an Essential Factor. *A. D. Mercer* .. (33)
Ergot from N. Z. *J. C. Neill* .. .. (57)
Montgommery Red Clover Seed Production. *S. H. Saxby* .. (40)
Improvement in Quality of Town Milk Supply in New Zealand. *E. J. Callaghan* .. .. (29)
Proper Housing and Feeding of Dogs will Prevent the Spread of Hydatids .. .. (37)
A Method of Castrating Pigs. *G. R. MacIntosh* .. .. (35)
Blood Scour in Calves .. .. (30)
Black-pox in Cows .. .. (30)
Cows 'Blown' on Clover .. .. (30)
Dual Cropping on Maize Areas .. .. (42)
Determination of Sex in Chickens. *S. G. Haddon* .. .. (32)
New Zealand Journal of Agriculture,
Vol. 63, No. 6, December 15, 1941—
Rotational Grazing will help to build up Animals' Resistance to Parasitic Infection. *C. E. Ballinger* .. .. .. (30)
Save More Hay. *G. A. Blake* .. .. (40)
Compost—Builder of Fertility. *A. M. Lee* .. .. .. (11)
Weeds. *S. H. Saxby* .. .. (8)
How Liquid Manure has assisted Carrying Capacity and Sward Improvement. *J. M. Hopkins* .. .. .. (11)

Whey for Pig Production .. .. (35)
How Your Milking Machine Works, The Pulsator. *W. G. Whittleston* .. .. .. (20, 29)
Production of Rye Grass and White Clover Seed under Irrigation. *G. G. Calder* .. .. (40)
Top-dressing in the Auckland Province. *A. V. Allo* .. .. (11)
Preservation of Calico and Hessian Cloth when Exposed to the Weather. *Wm. C. Hyde* .. .. (21)
Should Milking Cows be Permitted to Drop Condition in Winter. *C. Walker* .. .. (27)
Blowfly Strike in Sheep .. .. (33)
Middle Ear Disease in Pigs .. .. (35)
Remedy for Cracked Teats .. .. (30)
Arthrites in Lambs .. .. (33)
Eradicating Indian Doub Grass .. .. (8)
Citrus Varieties .. .. (39)
Bad Eggs, How to Avoid .. .. (32)

Indian Information,
Vol. 10, No. 86, January 1, 1942—
Rice is India's Largest Single Crop .. .. .. (46)

Bengal Weekly, 19th January 1942—
Village Agricultural Farms .. .. .. (23–25)

Bombay Information,
Vol. III, No. 3, January 24, 1942—
Extension of Improved Crops in Bombay .. .. (23–25)

Indian Central Cotton Committee—
Summary Proceeding of the Forty-fourth Meeting of Indian Central Cotton Committee, held on 18th and 19th July 1941 .. .. (41)

U.S.D.A. Circular,
No. 620, September 1941—
Avocado Production in the United States. *Hamilton P. Traub, Carl. S. Pomeroy, T. Ralph Robinson and W. W. Aidrich* .. (39)

Oklahoma Agricultural Experiment Station—
Current Farm Economics, October 1941, Vol. 14, No. 5 .. (25)
Technical Bulletin No. T-11, October 1941—
The Transmission of Ana Plasmosis by Horseflies (Tabanidæ). *D. E. Howell, C. E. Sanborn, L. E. Roseboom, G. W. Stiles and L. H. Moe* .. .. (16–30)

University of Illinois, Agricultural Experiment Station, Bulletins—
No. 471. Range of Adaptation of Certain Varieties of Vegetable Type Soybeans. *J. W. Lloyd* .. .. (48)
No. 472. The Migration of Iron and Manganese in Colloidal Systems. *Eric Winters* .. .. .. (13)
No. 473. The Low-temperature Hazard to set of Fruit in the Apple. *M. J. Dorsey* .. .. (39)
No. 474. Illinois Corn Performance Tests, 1940 .. .. (42)
No. 475. Effect of Pasture on Grade of Beef. *Sleeter Bull, R. R. Snapp and H. P. Rusk* .. .. (29)

No. 476. Effect of Storage on Yields of Farm Seed Treated for Disease Control, Wheat, Oats, Barley and Corn. *Benjamin Koehler* .. .. .. (45)

No. 477. Business Policies of Country Grain Elevators. *L. J. Norton* (23)

No. 478. Propagation of Fowl- and Pigeon-pox Viruses in Avian Eggs and Use of Egg-cultivated Viruses for Immunisation. *C. A. Braudly* .. .. .. (32)

No. 479. Retailer and Consumer Reaction to Graded and Branded Beef. *R. C. Ashby, R. J. Webb, E. C. Hedlund and Sleeter Bull* .. .. (29)

Mysore Co-operative Journal, December 1941—

U.S.D.A. Technical Bulletin,

No. 783, October 1941—Selenium Occurrence in Certain Soils in the United States, with a Discussion of Related Topics (Sixth Report). *H. W. Lakin and H. G. Byers* .. .. .. (11)

U.S.D.A. Circulars,

No. 612, September 1941.—Rice Varieties and Their Comparative Yields in the United States. *J. W. Jones, J. M. Jones, M. Nelson, L. C. Carter, C. R. Adair, R. H. Wyche, H. M. Beachell, L. L. Davis and B. M. King* .. .. (46)

U.S.D.A. Farmer's Bulletins,

No. 803. Horse-Breeding Suggestions for Farmers .. .. (31)

No. 952. Breeds of Light Horses .. .. .. (31)

No. 1488. Diseases of Raspberries and Blackberries .. .. (39)

No. 1874. Farm Production of Sugarcane Syrup .. .. (49)

The Journal of the Jamaica Agricultural Society,

Vol. 45, No. 8, August 1941—

Hungry Soils .. .. (11)

Soil Conservation. *H. H. Croucher* .. .. .. (4)

Sugar for feeding Bees. *Holon Heron* .. .. .. (34)

Compost-making. *J. B. Hutchinson* .. .. .. (11)

Preventive Measures against Mosquitoes. *G. R. Baxtor* (16, 17)

Efficient Spraying to Control Leaf-spot .. .. .. (15)

Bees. *P. O. Molland* .. .. (34)

Vol. 45, No. 9, September 1941—

Lime. *W. H. Edwards* .. .. (11)

Feeding Poultry for Egg Production. *D. P. Lecky* .. .. (32)

Bordeux Mixture. *E. D. H. Weller* .. .. .. (15)

Calves, White Purge .. .. (30)

Storing Feed in Dry Areas .. .. (14)

Vol. 45, No. 10, October 1941—

Nature and Soil Conservation. *G. R. Graham* .. .. (4)

Insecticides for Use in Citrus Orchards. *Allan Pickles* .. .. (39)

Pise' De Terre (Construction) .. .. (20)

Lime as a Building Material. *C. Byles* .. .. .. (20)

Tomato Diseases and Their Control. *Z. A. Daniels* .. .. (39)

Onions .. .. (39)

Feed for Stock .. .. (30)

Industry, Vol. 32, No. 383, February 1942—
Plantain Cultivation .. .. (39)
Indian Information, Vol. 10, No. 87, February 1, 1942—
Agriculture in War-time .. .. (25)
Indian Drug Manufacture .. .. (1)
Foodsupplies Harnessed to War Needs .. .. .. (25)
Cornell University Agricultural Experiment Station—
Bulletin 753, April 1941—
III. Further Studies of the Influence of Different Levels of Fat Intake Upon Milk Secretion. *L. A. Maynard, J. K. Loosli and C. M. McCay* .. .. (30)
Bulletin 755, April 1941—
Soil and Pasture Management for Long Island, New York. *A. F. Gustafson and D. B. Johnstone-Wallace* .. .. (40)
Bulletin 757, May 1941—
The Alfalfa Snout-Beetle—Its Control and Suppression. *Charles E. Palm, Charles Lineoln and A. B. Buchholz* .. .. (40)
Bulletin 758, May 1941—
Clover Leaf-hopper (*Aceratagalia sanguinolenta*. Prov.). *T. C. Watkins* .. .. (40)
Bulletin 759, June 1941—
Costs and Returns for the Cabbage Enterprise, 1938 and 1939. *R. W. Hoecker* .. .. (39)
Bulletin 760, June 1941—
Rural Public Welfare Administration and Finance in New York. *E. A. Lutz* .. .. (23. 25)
Bulletin 761, June 1941—
Prices of Apple Varieties as a Factor in Variety Selection. *M. D. Woodin* .. .. (39)
Memoir 236, May 1941—
Biology and Ecology of the Alfalfa Snout-Beetle. *Charles Lincoln and Charles E. Palm* .. .. (40)
Memoir 238, June 1941—
The Influence of Age and Rate of Breeding upon the Ability of the Female Rat to Reproduce and Raise Young. *S. A. Asdell, R. Bogart and G. Sperling* .. .. (10)
Memoir 239, June 1941—
Price Flexibility and Price Movements in the United States and Other Countries. *Mark T. Buchanan* .. .. (24)

244-42 Printed at The Bangalore Press, Bangalore City, by G. Srinivasa Rao, Superintendent.